Electronic Version
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Claims

[c1] 1. An electrochemical battery cell comprising:

a cell housing defining an inner space, a first terminal and a second terminal; and

at least one pre-formed pellet disposed within the inner space of the cell housing, the

pellet comprising:

an outer electrode portion formed from a material to geometrically define the pellet in a solid form, the outer electrode portion in electrical communication with the first terminal of the cell housing; and

an inner electrode encapsulated by a separator and embedded within the material of the outer electrode portion, the inner electrode in electrical communication with the second terminal of the cell housing and electrically insulated from the outer electrode portion.

[c2] 2. The battery cell of claim 1, wherein the inner electrode comprises a thin and substantially flat structure in a coiled configuration.

[c3] 3. The battery cell of claim 1, wherein the inner electrode includes an electrical lead to facilitate electrical communication with the negative terminal of the cell housing.

[c4] 4. The battery cell of claim 1, wherein the inner electrode comprises an anode and the outer electrode portion comprises a cathode portion, and wherein the first terminal has a positive polarity and the second terminal has a negative polarity.

[c5] 5. The battery cell of claim 4, wherein the anode comprises a thin and substantially flat structure in a coiled configuration.

[c6] 6. The battery cell of claim 4, wherein the anode includes an electrical lead to facilitate electrical communication with the negative terminal of the cell housing.

[c7] 7. The battery cell of claim 4, wherein the anode comprises a material selected from the group consisting of zinc, metallic zinc, zinc alloy, zinc oxide and combinations thereof; and wherein the cathode portion comprises MnO_2.

[c8] 8. The battery cell of claim 4, the material of the cathode portion consisting essentially of:

MnO_2;

a conductive powder; and

an additive selected from the group consisting of a binder, an electrolyte, a recombination catalyst, and combinations thereof.

[c9] 9. The battery cell of claim 4, the material of the cathode portion consisting essentially of:

about 88 percent by weight of MnO2;

about 7.5 percent by weight of a conductive powder; and

about 4.5 percent by weight of an additive selected from the group consisting of a binder, an electrolyte, a recombination catalyst, and combinations thereof.

[c10] 10. The battery cell of claim 4, further comprising a current collector embedded within the within the material of the cathode portion.

[c11] 11. An electrochemical battery cell comprising:

a cell housing defining an inner space, a positive terminal and a negative terminal; and

a plurality of pre-formed pellets disposed within the inner space of the cell housing, each of the pellets comprising:

a cathode portion formed from a material to geometrically define the pellet in a solid form, the cathode portion in electrical communication with

the positive terminal of the cell housing; and

an anode encapsulated by a separator and embedded within the material of the cathode portion, the anode in electrical communication with the negative terminal of the cell housing and electrically insulated from the cathode material.

[c12] 12. The battery cell of claim 11, wherein the cathode portion of each of the plurality of pellets is in direct electrical contact with the cathode portion of at least one of the other pellets.

[c13] 13. The battery cell of claim 11, wherein the anode of each of the plurality of pellets includes an electrical lead, the electrical lead of the anode of each of the plurality of pellets being in direct electrical contact with one of either the electrical lead of the anode of one of the other pellets or the negative terminal of the cell housing.

[c14] 14. The battery cell of claim 11, wherein the anode comprises a thin and substantially flat structure in a coiled configuration.

[c15] 15. The battery cell of claim 11, wherein the anode comprises a material selected from the group consisting of metallic zinc, zinc alloy, zinc oxide and combinations thereof.

[c16] 16. The battery cell of claim 11, the material of the cathode portion consisting essentially of:

MnO2;

a conductive powder; and

an additive selected from the group consisting of a binder, an electrolyte, a recombination catalyst, and combinations thereof.

[c17] 17. The battery cell of claim 11, the material of the cathode portion consisting essentially of:

about 88 percent by weight of MnO2;

about 7.5 percent by weight of a conductive powder; and

about 4.5 percent by weight of an additive selected from the group consisting essentially of a binder, an electrolyte, a recombination catalyst, and combinations thereof.

[c18] 18. The battery cell of claim 11, further comprising a current collector embedded within the within the material of the cathode portion.

[c19] 19. A pellet for use in an electrochemical battery cell, the pellet comprising:

an outer electrode portion formed from a material to geometrically define the pellet in a solid form, the

outer electrode portion in electrical communication with a first terminal of the cell housing; and
an inner electrode encapsulated by a separator and embedded within the material of the outer electrode portion, the inner electrode having an electrical lead in electrical communication with a second terminal of the cell housing and electrically insulated from the outer electrode material.

[c20] 20. The pellet of claim 19, wherein the inner electrode comprises a thin and substantially flat structure in a coiled configuration.

[c21] 21. The pellet of claim 19, wherein the inner electrode comprises an anode and the outer electrode portion comprises a cathode portion.

[c22] 22. The pellet of claim 21, further comprising a current collector embedded within the within the material of the cathode portion.

[c23] 23. An electrochemical battery cell comprising:
a cell housing defining an interior space;
a positive terminal and a negative terminal connected to the cell housing and having a portion disposed exteriorly the cell housing; and
at least one pre-formed pellet disposed within the

interior space of the cell housing, the pellet comprising a cathode portion and an anode encapsulated by a separator, the pellet being formed by embedding the anode into a material used to form the cathode portion and forming the cathode portion to geometrically define the pellet

the cathode portion in electrical communication with the positive terminal of the cell and

the anode in electrical communication with the negative terminal of the cell.

[c24] 24. The battery cell of claim 23, wherein the pellet further comprises a current collector embedded the within the material used to form the cathode portion.

[c25] 25. A method of manufacturing a pellet for use in an electrochemical battery cell, the method comprising the steps of:

forming an inner electrode;

applying a separator to the inner electrode;

embedding the inner electrode into an outer electrode material formulation; and

forming the outer electrode material formulation to geometrically define the pellet.

[c26] 26. A method of manufacturing a pellet for use in an electrochemical battery cell, the method comprising the

steps of:

forming an anode;

applying a separator to the anode;

embedding the anode into a cathode material formulation; and

forming the cathode material formulation to geometrically define the pellet.

[c27] 27. The method of claim 26, wherein the step of forming the anode comprises coiling the anode into a spiral-like configuration.

[c28] 28. The method of claim 26, wherein the step of forming the cathode material formulation comprises molding the material formulation to geometrically define the pellet.

[c29] 29. The method of claim 26, wherein the step of forming the cathode material formulation comprises compression-forming the material formulation to geometrically define the pellet.

[c30] 30. The method of claim 26, further comprising the step of attaching an insulated electrical lead to the anode before it is embedded into the cathode material formulation.

[c31] 31. The method of claim 26, wherein the step of applying the separator to the anode comprises coating the an-

ode with an adherent and flexible microporous separator material.

[c32] 32. The method of claim 26, further comprising the steps of blending electrolytic MnO2; conductive powder; and an additive selected from the group consisting of a binder, an electrolyte, a recombination catalyst, and combinations thereof; to create the cathode material formulation.

[c33] 33. The method of claim 26, further comprising the step of embedding a current collector into the cathode material formulation.

[c34] 34. A method of manufacturing an electrochemical battery cell, the method comprising the steps of:

forming a battery cell casing including a first terminal and a second terminal;

forming an inner electrode;

applying a separator to the inner electrode;

embedding the inner electrode into an outer electrode material formulation;

forming the outer electrode material formulation to geometrically define a pellet;

connecting the inner electrode to the second terminal; and

disposing the pellet into the battery cell casing such

that the outer electrode material formulation is in communication with the first terminal.

[c35] 35. A method of manufacturing an electrochemical battery cell, the method comprising the steps of:

forming a battery cell casing including a positive terminal and a negative terminal;

forming an anode;

applying a separator to the anode;

embedding the anode into a cathode material formulation;

forming the cathode material formulation to geometrically define a pellet;

connecting the anode to the negative terminal; and

disposing the pellet into the battery cell casing such that the cathode material formulation is in communication with the positive terminal.

[c36] 36. The method of claim 35, wherein the step of forming the anode comprises coiling the anode into a spiral-like configuration.

[c37] 37. The method of claim 35, wherein the step of forming the cathode material formulation comprises molding the material formulation to geometrically define the pellet.

[c38] 38. The method of claim 35, wherein the step of forming

the cathode material formulation comprises compression-forming the material formulation to geometrically define the pellet.

[c39] 39. The method of claim 35, further comprising the step of attaching an insulated electrical lead to the anode before it is embedded into the cathode material formulation to facilitate connection to the negative terminal.

[c40] 40. The method of claim 35, wherein the step of applying the separator to the anode comprises coating the anode with an adherent and flexible microporous separator material.

[c41] 41. The method of claim 35, further comprising the steps of blending electrolytic MnO2; conductive powder; and an additive selected from the group consisting of a binder, an electrolyte, a recombination catalyst, and combinations thereof; to create the cathode material formulation.

[c42] 42. The method of claim 35, further comprising the step of embedding a current collector into the cathode material formulation.

[c43] 43. A method of manufacturing an electrochemical battery cell, the method comprising the steps of:

(A) forming a battery cell casing including a positive

terminal and a negative terminal;

(B) forming a plurality of pellets, each pellet formed by:

forming an anode in a configuration having a large surface area;

applying a separator to the anode;

embedding the anode into a cathode material formulation;

forming the cathode material formulation to geometrically define the pellet;

(C) connecting each of the anodes to one of either the negative terminal or another anode; and

(D) disposing the pellets into the battery cell casing such that the cathode material formulation of each of the pellets is in communication with the positive terminal.

[c44] 44. A method of manufacturing a pellet for use in an electrochemical battery cell, the method comprising the steps of:

providing an anode having a separator applied thereto;

embedding the anode into a cathode material formulation; and

forming the cathode material formulation to geomet-

rically define the pellet.

[c45] 45. The method of claim 44, further comprising the step of embedding a current collector into the cathode material formulation.